



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY
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WASHINGTON DC 20310-0103



24 JAN 2003

REPLY TO
ATTENTION OF

Dr. Joe Braddock
Chair, Army Science Board
2511 Jefferson Davis Highway, Suite 11500
Arlington, Virginia 22202

Dear Dr. Braddock:

I request the Army Science Board (ASB) conduct a study on Advanced Antenna Technologies for the Objective Force (OF). The study should address, but is not limited to, the Terms of Reference (TOR) described below. The ASB members and consultants appointed to this study should consider the TOR as guidelines and may expand the study to issues considered important to the study. Modifications to the TOR must be addressed with you.

Background:

a. Network-centric concepts and mobility requirements for the OF will require a robust communications and networking architecture capable of providing assured communications. Radio frequency (RF) sensing systems will also be required as an element of the self-protection package. The small unit operations of the OF will place these forces in close proximity to the threat with the concomitant need to reduce the communications and sensing vulnerability to Electronic Counter-measures (ECM), while at the same time reducing its electromagnetic signature.

b. Physical limitations preclude a multitude of antennas on Army platforms; therefore, the Army must consider antenna technologies that support the need for multi-function, multi-spectral, and multi-user capability.

c. The solution set will demand a dynamic communication system capable of routing traffic via multiple "radio links" for both line-of-sight and through airborne relays and satellites. Additionally, sensors and other RF systems on the Future Combat System (FCS) platforms will compete for the limited real estate. Employing directional, integrated, antenna systems that minimize the signature of the force can foster both the signature and the ECM vulnerability reduction goals. Focused beam antennas will be needed to maintain the link with distant platforms including airborne and satellite relays.

d. Effective application of directional antenna systems in a dynamic environment requires a systems approach. This includes knowledge of the desired beam direction, the ability of the system to know the attitude and heading of the platform, and an antenna controller to position the beams and nulls to the desired points in space. In the case of communications, an integrated smart receiver is



also required to maintain the integrity and control of the information received over intermittent communications paths.

TOR:

- a. Based on available Training and Doctrine Command documentation and the ongoing analysis of the FCS Systems Integrator, determine the totality of radio and sensor signals that must be accommodated by the family of FCS platform(s), including Unmanned Aerial, Ground Vehicles, and Land Warrior.
- b. Identify technologies such as phased array/conformal antennas, and antenna pointing systems and algorithms which will be necessary to satisfy OF dynamic on-the-move requirements.
- c. Document the Science and Technology (S&T) investment program in advanced antenna systems for terrestrial and airborne communications and sensing.
- d. Identify potential low-cost technologies for robust, mobile, embedded antenna systems, which might replace the current expensive antenna system technologies.
- e. Identify gaps in the S&T program including architectures, RF design, and advanced software necessary to support the dynamic sensing and communications needs of the OF.
- f. Lay out a proposed program to provide agile communication and sensing antenna systems, time phased with the Block II FCS.

Study Sponsorship: The study sponsors are Army Research Laboratory, the United States Army Communications-Electronics Command, and the Objective Force Task Force.

Study Duration: Please initiate the study in January 2003, provide an interim progress report in March and report out during May 2003.

Sincerely,


Claude M. Bolton, Jr.

Assistant Secretary of the Army
(Acquisition, Logistics and Technology)